LM710/LM710C Voltage Comparator

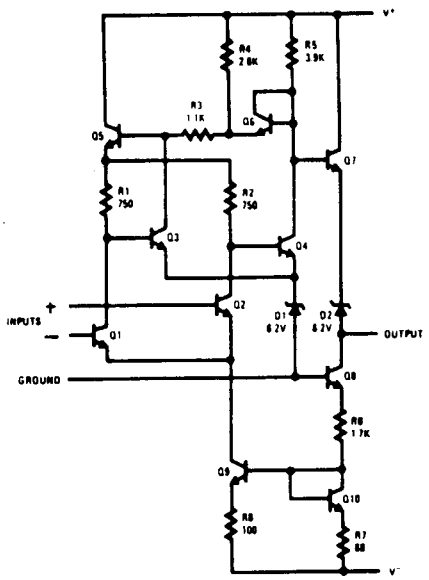
General Description

The LM710 series are a high-speed voltage comparators intended for use as an accurate, low-level digital level sensor or as a replacement for operational amplifiers in comparator applications where speed is of prime importance. The circuit has a differential input and a single-ended output, with saturated output levels compatible with practically all types of integrated logic.

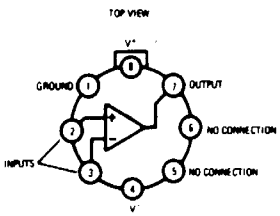
The device is built on a single silicon chip which insures low offset and thermal drift. The use of a minimum number of stages along with minority-carrier lifetime control (gold doping) makes the circuit much faster than operational amplifiers in saturating comparator applications. In fact, the low stray and wiring capacitances that can be realized with monolithic construction make the device difficult to duplicate with discrete components operating at equivalent power levels.

The LM710 series are useful as pulse height discriminators, voltage comparators in high-speed A/D converters or go, no-go detectors in automatic test equipment. They also have applications in digital systems as an adjustable-threshold line receiver or an interface between logic types. In addition, the low cost of the units suggests it for applications replacing relatively simple discrete component circuitry.

Schematic* and Connection Diagrams



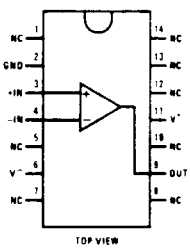
Metal Can Package



Note: Pin 4 connected to case.

Order Number LM710H
or LM710CH
See NS Package H08C

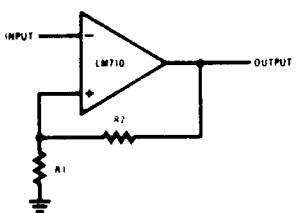
Dual-In-Line Package



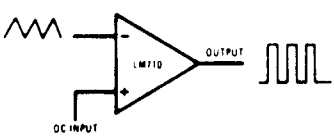
Order Number LM710N
or LM710CN
See NS Package N14A

Typical Applications *

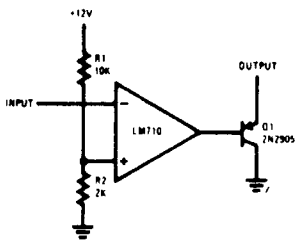
Schmitt Trigger



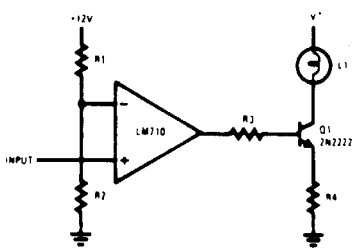
Pulse Width Modulator



Line Receive With Increased Output Sink Current



Level Detector With Lamp Driver



*Pin connections shown are for metal can

Absolute Maximum Ratings

Positive Supply Voltage	+14V
Negative Supply Voltage	−7V
Peak Output Current	10 mA
Output Short Circuit Duration	10 seconds
Differential Input Voltage	±5V
Input Voltage	±7V
Power Dissipation	
TO-99, (Note 1)	300 mW
Flat Package, (Note 2)	200 mW

	T_{MIN} T_{MAX}
Operating Temperature Range	
LM710	−55°C to +125°C
LM710C	0°C to +70°C
Storage Temperature Range	−65°C to +150°C
Lead Temperature (Soldering, 60 seconds)	300°C

Electrical Characteristics (Note 3)

PARAMETER	CONDITIONS	LM710			LM710C			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
Input Offset Voltage	$R_S \leq 200\Omega$, $V_{CM} = 0V$, $T_A = 25°C$		0.6	2.0		1.6	5.0	mV
Input Offset Current	$V_{OUT} = 1.4V$, $T_A = 25°C$		0.75	3.0		1.8	5.0	μA
Input Bias Current	$T_A = 25°C$		13	20		16	25	μA
Voltage Gain	$T_A = 25°C$	1250	1700		1000	1500		
Output Resistance	$T_A = 25°C$		200			200		Ω
Output Sink Current	$V_{OUT} = 0$, $T_A = 25°C$							
	$\Delta V_{IN} \geq 5$ mV	2.0	2.5					mA
	$\Delta V_{IN} \geq 10$ mV				1.6	2.5		mA
Response Time	$T_A = 25°C$, (Note 4)		40			40		ns
Input Offset Voltage	$R_S \leq 200\Omega$, $V_{CM} = 0V$			3.0			6.5	mV
Average Temperature Coefficient of Input Offset Voltage	$T_{MIN} \leq T_A \leq T_{MAX}$, $R_S \leq 50\Omega$		3.0	10		5.0	20	μV/°C
Input Offset Current	$T_A = T_A$ MAX		0.25	3.0			7.5	μA
	$T_A = T_A$ MIN		1.8	7.0			7.5	μA
Average Temperature Coefficient of Input Offset Current	$25°C \leq T_A \leq T_{MAX}$		5.0	25		15	50	nA/°C
	$T_{MIN} \leq T_A \leq 25°C$		15	75		24	100	nA/°C
Input Bias Current	$T_A = T_{MIN}$		27	45		25	40	μA
Input Voltage Range	$V^- = -7V$	±5.0			±5.0			V
Common-Mode Rejection Ratio	$R_S \leq 200\Omega$	80	100		70	98		dB
Differential Input Voltage Range		±5.0			±5.0			V
Voltage Gain		1000			800			V/V
Positive Output Level	-5 mA $\leq I_{OUT} \leq 0$							
	$V_{IN} \geq 5$ mV	2.5	3.2	4.0				V
	$V_{IN} \geq 10$ mV				2.5	3.2	4.0	V
Negative Output Level	$V_{IN} \geq 5$ mV	−1.0	−0.5	0				V
	$V_{IN} \geq 10$ mV				−1.0	−0.5	0	V
Output Sink Current	$V_{IN} \geq 5$ mV, $V_{OUT} = 0$							
	$T_A = 125°C$	0.5	1.7					mA
	$T_A = -55°C$	1.0	2.3					mA
	$V_{IN} \geq 10$ mV, $V_{OUT} = 0$, $0°C \leq T_A \leq +70°C$				0.5			mA
Positive Supply Current	$V_{IN} \geq 5$ mV		5.2	9.0				mA
	$V_{IN} \geq 10$ mV					5.2	9.0	mA
Negative Supply Current	$V_{IN} \geq 5$ mV		4.6	7.0				mA
	$V_{IN} \geq 10$ mV					4.6	7.0	mA
Power Consumption	$I_{OUT} = 0$							
	$V_{IN} \geq 5$ mV		90	150				mW
	$V_{IN} \geq 10$ mV						150	mW

Note 1: Rating applies for case temperatures to 125°C for LM710 and to 70°C for LM710C; derate linearly at 5.6 mW/°C for ambient temperatures above 105°C.

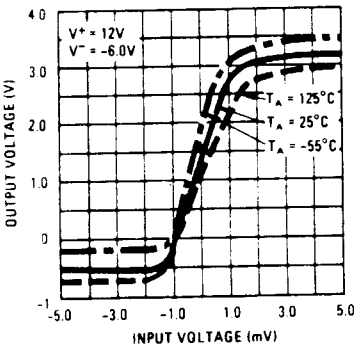
Note 2: Derate linearly at 4.4 mW/°C for ambient temperatures above 100°C.

Note 3: These specifications apply for $V^+ = 12V$, $V^- = -6V$, $-55°C \leq T_A \leq +125°C$ for LM710 and $0°C \leq T_A \leq +70°C$ for LM710C unless otherwise specified. The input offset voltage and input offset current (see definitions) are specified for a logic threshold voltage of 1.8V at −55°C, 1.4V at 25°C, and 1V at 125°C for LM710 and 1.5V at 0°C, 1.4V at 25°C and 1.2V at 70°C for LM710C.

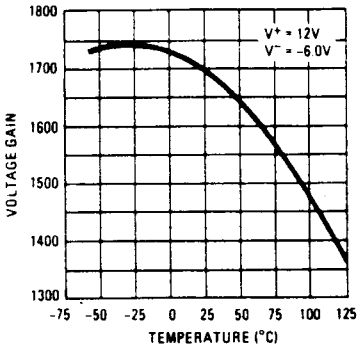
Note 4: The response time specified (see definitions) is a 100 mV input step with 5 mV overdrive (LM710) or a 10 mV overdrive (LM710C).

Typical Performance Characteristics

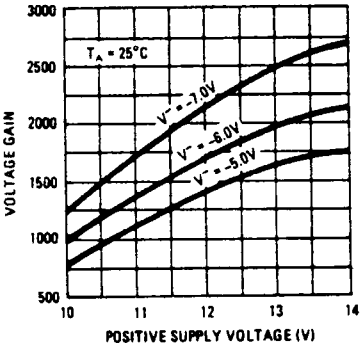
Transfer Function



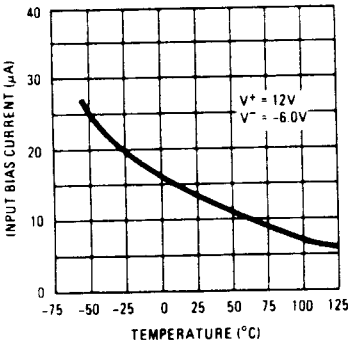
Voltage Gain



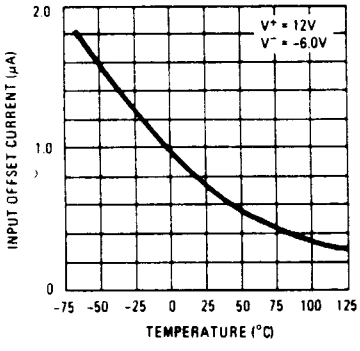
Voltage Gain



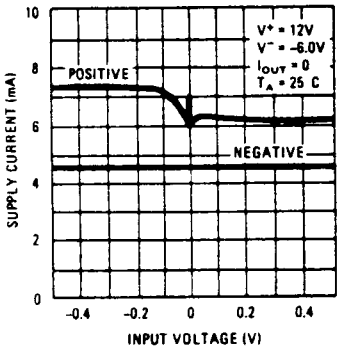
Input Bias Current



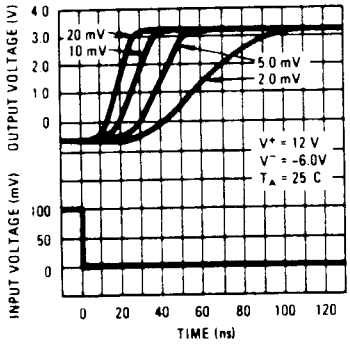
Input Offset Current



Supply Current



Response Time For Various Input Overdrives



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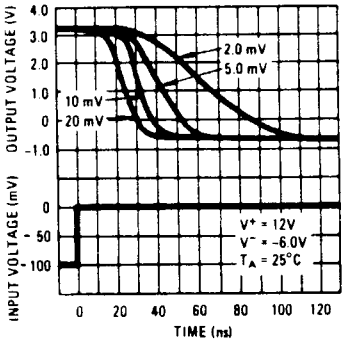
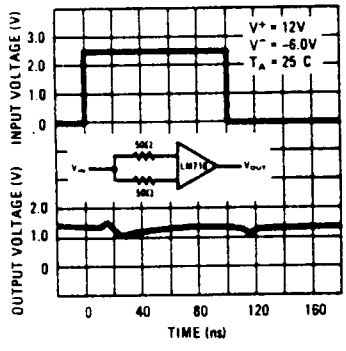
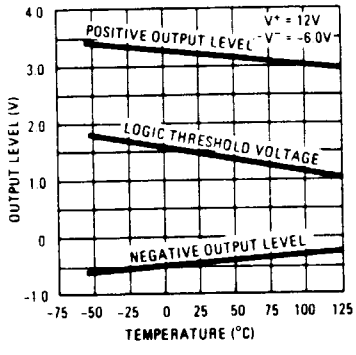


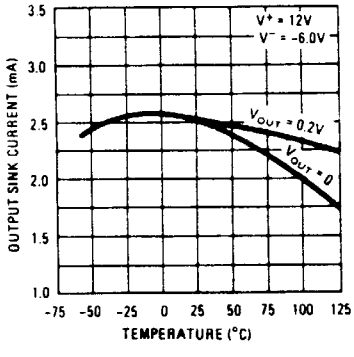
Common Mode Pulse Response



Output Voltage Level



Output Sink Current



Maximum Power Dissipation